ANALYSIS OF ORTHODONTIC TREATMENT BY PEDIATRIC DENTISTS AND GENERAL PRACTITIONERS IN INDIANA

by

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TABLE OF CONTENTS

Introduction 1

Review of the Literature 2

Methods and Materials 13

Results 17

Tables 25

Discussion 45

Summary and Conclusions 53

References 56

Appendixes 59

Curriculum Vitae

Abstract

LIST OF TABLES

TABLE I — Distribution of general practitioners in Indiana 25

TABLE II — Age distribution of responding pediatric dentists and general practitioners 26

TABLE III — Population of community in which practice is located, with distribution of pediatric dentists and general practitioners 27

TABLE IV — Distribution of responding general practitioners within the fourteen dental districts of Indiana 28

TABLE V — Distribution of responding general practitioners and pediatric dentists with respect to year of graduation from dental school 29

TABLE VI — Distribution of pediatric dentists with respect to year of completion of postgraduate specialty training 29

TABLE VII — Specialty qualifications of responding pediatric dentists 30

TABLE VIII — Perceptions of general practitioners and pediatric dentists with respect to the adequacy of their undergraduate and postgraduate dental education in orthodontics 31

TABLE IX — Distribution and type of continuing education courses taken by pediatric dentists and general practitioners 32

TABLE X — Distribution of pediatric dentists and general practitioners with respect to percentage of practice time spent on orthodontics, and trends in time spent on restorative procedures and orthodontics 33

TABLE XI — Type of orthodontic conditions treated and type of orthodontic appliances and techniques used by pediatric dentists and general practitioners 34

TABLE XII — Chi square analysis of pediatric dentists and general practitioners with respect to the type of conditions treated, and the type of appliances and techniques used 35

TABLE XIII — T-test comparison of attitudes of general dentists and pediatric dentists toward their undergraduate dental education in orthodontics 36

TABLE XIV — Results of Chi square analysis between pediatric dentists and general practitioners with regard to percentage of time spent on orthodontics, trends in time spent on restorative procedures and on orthodontic procedures 36

TABLE XV — Chi square analysis of age subgroups for total test group with respect to trends seen in time spent on routine operative and restorative services 37

TABLE XVI — Chi square analysis of age subgroups of total test group with respect to trends in time spent providing orthodontic services in the past few years 38

TABLE XVII — Chi square analysis of population subgroups of total test group with respect to percentage of time spent providing orthodontic services 39

TABLE XVIII — Chi square analysis of population subgroups with respect to the use of band and loop appliances and the treatment of comprehensive orthodontic cases, anterior crossbites and space maintenance 40

TABLE XIX — Chi square analysis of the effect of age and population of the community where practice is located on continuing education in orthodontics 41

TABLE XX — Effect of continuing education on the type of orthodontic conditions treated and the type of appliances and techniques used 42

TABLE XXI Effect of continuing education on the percentage of time spent providing orthodontic treatment and trend in time spent providing orthodontic services 43

TABLE XXII Comparison of current study and 1981 Association of Pedodontic Diplomates study with regard to type of conditions treated and type of appliances and techniques used 44

INTRODUCTION

With a declining birth rate, a declining incidence of caries and an increasing number of graduating dentists, the practice of pediatric dentistry as well as general dentistry has been affected greatly. More pediatric and general dentists are seeing patients with reduced restorative dentistry needs. As a result, increasing emphasis is being placed on orthodontic treatment in the pediatric and general dental practice. Even though pediatric dentists have always played an integral role in guiding the developing occlusion of the child patient, more practitioners are becoming involved in the comprehensive correction of existing malocclusions. At the same time general dentists are seeing more "dentally aware" adults and more children who are conscious of and require orthodontic treatment.

The purpose of this investigation was to determine and analyze the extent of orthodontic treatment being provided by pediatric dentists and general practitioners in the state of Indiana. The Indiana data were compared to trends obtained in previous national and regional studies. As the previous studies were completed almost five years ago, the current study sought to determine whether more orthodontic treatment is being provided by pediatric dentists and general practitioners today as compared to five years ago.

This study may also provide dental educators with an insight to the needs of new graduates who intend to practice general dentistry or pediatric dentistry in Indiana.

REVIEW OF LITERATURE

Declining Caries Rate

A recent longitudinal study by Stookey et al.[1] demonstrated a dramatic decrease in the prevalence of dental caries in Indiana school children. It showed an overall decrease of about 70 percent in caries prevalence during the past 23 years and a decline of about 50 percent during the past 10 years in school age children. In the 10 year period from 1971-72 to 1981-82, a 62 percent decrease in caries prevalence in the primary dentition also occurred.

Results of the 1979-80 National Caries Prevalence Survey[2] showed that 36.65 percent of the national test group were caries-free. In region three, which included Indiana, 34 percent of children ages five to 17 years were caries-free. The mean DMFS for region three was 4.7 surfaces, 80 percent of which were found to be filled surfaces. The mean DMFS for the United States was 4.8 surfaces.

In a similar national caries prevalence study in 1971-73,[3] the mean DMFS for children ages five to 17 years was 7.06 surfaces. In addition, 28 percent of the children were caries-free. A comparison of these two national studies[2,3] emphasizes that the number of caries-free children has significantly increased nationally, while the mean DMFS has significantly decreased in the period from 1971-1980.

Declining Birthrate

The declining birthrate is also affecting the practice of pediatric and general dentistry. In 1960, 36 percent of the United States population

was under the age of 18. By 1980, the under-18 group had decreased to 28.2 percent of the national population.[4] This represents a 22 percent decrease in population for this age group during the 20-year period.

Manpower Surveys

While the caries rate and birth rate are declining, the number of pediatric dentists continues to increase both nationally and in the state of Indiana. In 1969, Indiana had 31 pediatric dentists in practice while the national number was 1,123.[5] In 1979 the national population of pediatric dentists was 1,776 and in Indiana it was 52.[6] This represented a 70 percent increase in the number of practicing pediatric dentists in Indiana from 1969-1979 and a 58 percent increase nationally. In 1985 there were 78 practicing pediatric dentists in Indiana.[7] In the time period from 1979 to 1985 the number of pediatric dentists in Indiana has increased 50 percent.

A study by Meskin et al.[8] states that from 1960-1977 the number of pediatric dentists has increased 702 percent compared to 271 percent for all other dental specialties. The study concludes that one way in which pediatric dentists could deal with this oversupply would be to offer more sophisticated services, particularly in the area of comprehensive orthodontics.

Previous Surveys

Few studies have been done to analyze the extent of orthodontic treatment being provided by pediatric or general dentists. The studies which have been done are nearly five years old.

In 1980, a survey of the Association of Pedodontic Diplomates[9] was done to determine the amount and type of orthodontic services being provided by its 383 members. Ninety-nine percent of the pediatric dentists surveyed stated that they provided some orthodontic treatment. One-third of the group provided comprehensive orthodontic treatment. During the preceding five years, 59 percent of the pediatric dentists who replied saw a decline in the need for traditional pedodontic services, while 48 percent saw an increase in the time they spent on orthodontics.

A 1980 survey of members of the Southwestern Society of Pedodontists[10] showed that 94 percent of the respondents were providing orthodontic treatment more complex than space maintenance. Of these respondents, 25 percent stated that they were treating comprehensive orthodontic cases while 60 percent said they provided only preventive or interceptive orthodontics in addition to simple space maintenance.

A 1980 North Carolina study[11] investigated productivity and services performed in 36 pediatric dental offices. This study concluded that relatively little time was spent providing orthodontic treatment: it accounted for only 4 percent of the procedures provided and occupied only 8 percent of the total practice time.

In California, Dugoni et al.[12] reported that 55 percent of orthodontic care provided through prepayment programs is now furnished by non-orthodontists.

Few studies or surveys have investigated the extent of orthodontic treatment being provided by general practitioners. A 1973 survey by the

American Association of Orthodontics[13] stated that 14 percent of the slowdown seen in surveyed orthodontic practices was due to competition with general practitioners.

A 1980 survey of Chicago general practitioners[14] examined orthodontic trends in practice and the effect of undergraduate orthodontic instruction. Recent graduates who were exposed to orthodontics in more depth as undergraduates were more likely to treat patients orthodontically, were more aware of patients orthodontic needs, and were more likely to refer patients with orthodontic needs to orthodontists. The survey found that treatment by general practitioners was limited to minor orthodontic procedures such as observation, tooth guidance and minor tooth movement. More complicated orthodontic cases or full banding was not provided by the survey group.

Roles of Pediatric Dentists and General Practitioners

Many authors have attempted to define the roles of general practitioners, pediatric dentists and orthodontists in the treatment of the orthodontic patient. Such articles tend to be quite subjective and laden with personal opinions.

Brown[15] saw the role of the pediatric dentist changing through the 1970's and 1980's due to the declining caries rate and the increasing number of pediatric dentists. He stated that pediatric dentists need an improved understanding of the growth process and increased skills to intercept developing malocclusions through the period of the mixed dentition.

In the early 1970's Gotllieb[16] and Teuscher[17] editorialized about increased amounts of orthodontic treatment being delivered by pediatric dentists and general practitioners.

The importance of understanding "the what-the why-the how" of orthodontics has been stressed in the past.[17] In treating patients, practitioners must be able to apply the techniques of orthodontics within their personal capability. This capability is determined by their mastery of sophisticated appliances and through their professional experience.

Orthodontics is a complex specialty, Dale[18] stated that the key to successful treatment in orthodontics is accurate diagnosis. Prior to treating orthodontic patients, a practitioner must have confidence in his treatment techniques. Diagnostic skills are even more important.

Problems arise when practitioners do not realize their own limitations in treating orthodontic patients. Short continuing education courses on specific treatment procedures do not adequately qualify practitioners.[18] General practitioners and pediatric dentists may not be able to recognize their limitations while orthodontists generally are aware of the technical limitations which exist.[19]

One way to increase the technical capability, diagnostic skills and knowledge of treatment limitations is through a more adequate undergraduate orthodontic experience.[12,14,19,20]

Graber[19] stated that the undergraduate dentist must be well trained in orthodontics just as in any other clinical branch of dentistry.

Norton et al.[20] related that treatment should be executed as part of a total patient care commitment and responsibility. He thought

that general practitioners should be able to offer orthodontic treatment ranging from simple space maintenance to management of class 1 malocclusions. He emphasized that general practitioners must be able to identify the complexity of a case and be prepared to refer the patient to someone who is more able to treat the case with total confidence if they can not do so.

By educating dental students in the recognition and diagnosis of orthodontic problems, a referral source of patients to orthodontists will be guaranteed.[13]

In 1976, the Council on Dental Education, American Dental Association, published, "Guidelines for Teaching Orthodontics in Dental Education"[21] which set forth the following objectives:

1) Students will be able to recognize, classify and differentiate occlusal problems of children and adults.
2) Students will be able to develop suitable treatment plans for patients to be treated in general practice and will possess those skills to deliver necessary care embodied in the treatment plan.
3) Students will be able to select and treat patients with uncomplicated tooth positions and refer patients with more severe problems to an orthodontist.

Salzmann[22] editorialized that orthodontics should not be defined on the basis of non-orthodontist and orthodontist or exclusive and non-exclusive practice, but rather on the basis of educational and clinical preparation of the individual dentist for the practice of orthodontics.

Pediatric dentistry is unique among the dental specialties. It includes the delivery of comprehensive dentistry to a single group of patients: infants, children and adolescents. This comprehensive care includes the detection and treatment of malocclusions in the primary and the mixed dentition. Such treatment can include space management and interceptive orthodontics according to Carapezza.[23] He stated that pediatric dentists should be well versed in the use of orthodontic appliances ranging from space maintainers to orthopedic appliances and multibanded techniques. Training in growth and development should enable pediatric dentists to choose appropriate therapy and techniques in the treatment of such cases.

Guidelines for advanced pediatric dental education have been drawn up to include orthodontic education objectives. The American Academy of Pediatric Dentistry[24] states that during postgraduate education, clinical experience must be provided to develop competency in the diagnosis and treatment of abnormalities of the developing occlusion, as well as in preventive, interceptive and corrective procedures of the permanent dentition.

The American Board of Pedodontics[24] demands that candidates be well versed in the didactic and clinical aspects of interceptive orthodontics.

Rawlings et al.[25] surveyed 52 pedodontic postgraduate programs in the United States regarding orthodontic training offered. The majority of the responding program chairmen thought that pedodontists should be capable of treating:

1) Class 1 skeletal problems, habit therapy and ectopic eruption in the primary and the mixed dentitions
2) Dental open bite malocclusions in the mixed dentition
3) All dentitional assignments of anterior and posterior crossbites, space maintenance and space regaining

The same study[25] showed that 48 percent of the program chairmen thought the orthodontic-pedodontic dilemma would not be solved by the combination of the two specialties. Only 30 percent favored the combination while 22 percent were undecided.

Ackerman[26] believed that traditional pedodontic programs lack emphasis on orthodontic diagnosis and that orthodontic programs do not emphasize preventive dentistry. He thought that offering combined programs would decrease such disparities.

Kohn[27] took a similar stand, stating that there is much to be gained by the increased interest and awareness of occlusal relationships in children by the pediatric dentist. By being well versed in growth and development and in guidance of the developing occlusion, pediatric dentists must be able to provide preventive and interceptive orthodontic treatment. By the nature of their training, they tend to provide such treatment earlier than orthodontists. According to Kohn,[27] orthodontists tend to see the end stages of a well developed malocclusion.

Pleasant[28] published a list of areas in which general dentists and pediatric dentists could greatly assist in intercepting or preventing malocclusions. This list includes:

1) space maintenance

2) space regaining

3) guidance of ectopically erupting teeth

4) space closing in class 1 molar cases

5) buccal or lingual crossbite correction

6) anterior crossbite correction

7) habit control appliances

8) serial extraction, if indicated

9) extraction of supernumerary teeth and over-retained deciduous teeth

10) surgically exposing late erupting permanent teeth

Levitas[29] was candidly aware of the increased amount of orthodontics being provided by both pediatric dentists and general practitioners. He felt that in the future there would be a change in postgraduate pedodontic training to such an extent that graduates would be qualified as pedodontic-orthodontists or orthodontic-pedodontists. He also saw the problem (what orthodontic treatment should be provided by pedodontists) as one of semantics. Has primary or mixed dentition orthodontics ever been adequately defined by dental educators, the American Association of Orthodontics or the American Academy of Pedodontics?[29]

The Future of Dentistry for Children Committee[30] of the American Academy of Pediatric Dentistry, in its report on education for pediatric dentistry, recommended that more clinical experience in orthodontics be included in the undergraduate curriculum. This would require cooperation between the orthodontic and pediatric dentistry sections

and could be mutually beneficial to both sections. Educators should work together in the undergraduate and graduate levels for the best interest of the patients.

Haeseler[31] believed that the current friction between pediatric dentists and orthodontists stems from the fact that the former view themselves as "generalists for children." Because orthodontics has such a wide definition and because growth and development play such a great role in both specialty programs, many pediatric dentists feel that they are adequately trained to treat the child orthodontic patient.

Carter[32] also thought that a dual specialty in pedodontics and orthodontics would provide a comprehensive service for the child patient with a simplified approach.

Questionnaire

Mailed questionnaires[33,34] have advantages as well as disadvantages. Kerlinger[35] stated that the two major disadvantages are the lack of response and the inability to quantify the validity of the results. If the response is low, the views of the non-respondents may vary greatly from the respondents, making conclusions invalid.

A return of 80 percent is generally considered sufficient to represent the entire cross section and to form the basis for valid conclusions.[34,35]

The following advantages of the mailed questionnaire over the questionnaire-interview have been cited:[33,34]

1) They afford wider geographic contact

2) Greater coverage may yield greater validity through larger and more representative samples

3) They permit more considered responses

4) They are adequate in situations in which the respondent must check his information

5) They give the respondent a sense of privacy

6) They lessen adverse interviewer effect

7) They provide for greater uniformity in the manner in which questions are posed

Psychologists have recommended several techniques to improve the percent of returned mailed questionnaires. Norton, as cited by Miller,[33] stated that the sponsor of the questionnaire is important and can increase the returns by 17 percent. Questionnaire length also greatly affects the percent returned. The shorter a questionnaire, the better the percentage returned.[33,34] Miller[33] has stated that the return percentage can be doubled if stamps (not metered postage) are used on the enclosed return envelopes. Wickliffe[34] wrote that professionals are also more likely to return questionnaires than non-professionals.

Mailed questionnaires have been used extensively in dentistry to survey professional opinions and techniques used in private practice.[9-11,25,34]

METHODS AND MATERIALS

A mailed questionnaire was constructed to gather information about the extent and nature of orthodontic treatment being delivered by pediatric dentists and general practitioners in Indiana. The questionnaire was similar to previous mailed questionnaires used to investigate such trends in the past.[9-11] Each participant in the survey received: a letter of explanation, the questionnaire and a return addressed envelope with a stamp attached.

The questionnaire was mailed to all 71 Indiana pediatric dentists who practice primarily in a private practice setting, as listed in the 1985 Pedodontic Referral List obtained from the Indiana Society of Pediatric Dentistry.

General practitioners were selected according to the size of community in which they practice and the number of years since their graduation from dental school. This was done so that the dentists surveyed would be representative of a cross section of practicing dentists in Indiana.

Census figures[36] were used to divide Indiana cities into four categories according to population: 1) under 5,000

2) 5,000 - 25,000

3) 25,000 - 100,000

4) over 100,000

To maintain an equal distribution throughout the entire state, dentists were selected from each of the 14 component dental districts within the state.[37] As a result all areas of the state were represented in the survey (Appendix 1).

Also, general practitioners were selected according to the year of graduation from dental school. This prevented one age group from being misrepresented in the study, which could occur if participants were chosen at random. The information on year of graduation from dental school, as well as all addresses, was obtained from the American Dental Association Directory.[38]

The total number of general practitioners surveyed was 500. This provided a representative sample of general practitioners in Indiana. The number of general practitioners selected from each of the 14 dental districts depended upon the number of dentists in each individual district compared to the total number of dentists in the state.[36] This prevented districts with a large number of dentists from being underrepresented and districts with a small number from being overrepresented. Using these data, the 500 general practitioners were proportionally distributed throughout Indiana dental districts (Table I).

QUESTIONNAIRE

No standard questionnaire was available to gather the required information about orthodontic treatment by pediatric and general practitioners. As a result, a questionnaire had to be specifically designed to gather the information. The questionnaire used was modeled after a similar one used in 1981 by the Association of Pedodontic Diplomates.[9]

In an attempt to maximize the response, the questionnaire was two pages long and required only check mark answers (Appendix 2).

The same questionnaire was sent to both pediatric dentists and general practitioners. Some of the questions did not apply to the general practitioners and were to be left blank.

Questions one and two of the questionnaire verified the respondent's age, size of community in which practice was located, and dates of dental school graduation and postgraduate training graduation. Question three concerned the type of postgraduate qualifications possessed by the pediatric dentists. The next two questions used a graded response scale to evaluate the perceptions of pediatric dentists and general practitioners toward their undergraduate and postgraduate dental training with regard to orthodontics.

The next three items dealt with continuing education in orthodontics. The respondents indicated if they had taken continuing education courses in orthodontics, the type of courses taken, and how these courses affected the number of patients they referred to orthodontists.

Question five attempted to investigate and quantify the amount of orthodontic treatment being provided by the respondents. Two questions in this section investigated the hypothesis that the need for routine operative and restorative services in private practice was declining and that part of this void in total services was being replaced with increased orthodontic services. The last question in this section was designed to assess, in subjective terms, the amount of time spent providing orthodontic services by the respondents in their private practices.

Questions six and seven were designed to investigate the type of orthodontic problems and malocclusions being treated and the type of orthodontic appliances and techniques being used in private practice by pediatric dentists and general practitioners. The type of orthodontic treatment being provided could be categorized as preventive, interceptive or corrective through these questions.

Space was supplied at the end of the questionnaire in which respondents could express any additional written comments.

A cover letter (Appendix 3) accompanied each questionnaire. The letter stated the purpose of the investigation and attempted to identify its significance for current dental education. The cover letters were photocopied on Indiana University School of Dentistry stationery. The salutation of each letter, which included the dentist's name, was added using a word processor printer. Each letter was personally signed by the investigator. The questionnaire, cover letter and a stamped self-addressed envelope were mailed to each participant on February 24, 1986.

Statistical analysis using Chi square and t-test analyses were done on the resulting data using the Statistical Package for the Social Sciences (SPSS).[39]

RESULTS

Of the 571 questionnaires mailed, 11 were returned by the Postal Service due to a change in address without a forwarding address. Sixteen returned questionnaires were deemed unusable and were not included in the study. The majority of these were inadvertently sent to specialists who had no specialty indicated in the American Dental Association Directory,[38] and were neither general practitioners or pediatric dentists.

The total number of usable responses was 430, including 66 from pediatric dentists and 364 from general practitioners. As a result 92.95 percent of the pediatric dentists and 72.80 percent of the general practitioners responded. Correcting the number of general practitioner responses for undelivered and unusable questionnaires, a total of 473 general practitioners were actually surveyed. This represents an actual response of 76.96 percent by general practitioners. Overall actual response for the combined study group was 79.04.

The age distribution of responding pediatric and general practitioners is shown in Table II. The majority of the respondents were within the 30-49 year age range.

Demographic information regarding the population of the community in which the respondent practiced is shown in Table III. The information is grouped according to pediatric dentists and general practitioners.

Table IV shows the distribution of responding general practitioners within the 14 dental districts of Indiana. The percentage of

questionnaires returned by general practitioners varied greatly within the 14 dental districts, as indicated in Table IV. Only 51.72 percent of the general practitioners in the East Central dental district returned the questionnaire while 84.21 percent of the general practitioners surveyed in the First District responded. From this information it is also evident that all 14 dental districts were proportionally represented in the responding sample.

The distribution of responding general practitioners and pediatric dentists with respect to year of graduation from dental school can be found in Table V. It is evident that no one age group of general practitioners or pediatric dentists was overrepresented in the study sample.

Pediatric dentists were grouped according to year of completion of postgraduate specialty training (Table VI).

Table VII shows the type of postgraduate specialty qualifications the responding pediatric dentists possessed. A large majority of the responding pediatric dentists (78.8 percent) possessed a certificate alone, while only 21.2 percent possessed a master's degree as well as a certificate in pediatric dentistry specialization.

The perceptions of general practitioners and pediatric dentists with respect to the adequacy of their undergraduate and postgraduate dental education in orthodontics are summarized in Table VIII. The responses were on a graded scale from strongly agree to strongly disagree. One hundred percent of pediatric dentists and 92.5 percent of general practitioners either disagreed or strongly disagreed with

the question pertaining to the adequacy of undergraduate dental school training in orthodontics. Likewise, a clear majority of pediatric dentists (78.8 percent) disagreed or strongly disagreed with a similar statement about the adequacy of their postgraduate dental training in orthodontics.

The next section of the questionnaire dealt with continuing education in orthodontics. Table IX shows the number of general practitioners and pediatric dentists who have taken continuing education courses in orthodontics. A much greater percentage of pediatric dentists (93.9 percent) than general practitioners (55.6 percent) have taken continuing education courses in orthodontics. Also a substantially greater percentage of pediatric dentists (55.6 percent) than general practitioners (16.5 percent) had taken either comprehensive continuing education courses or a combination of comprehensive and short courses.

Table X represents the responses of pediatric dentists and general practitioners to the section of the questionnaire which attempted to quantify the amount of orthodontic treatment being provided in their practices. This section also attempted to identify current trends in the amount of orthodontics, and routine operative and restorative dentistry being provided by the survey group.

Table XI represents the responses of pediatric dentists and general practitioners to the final section of the questionnaire. This section attempted to identify the type of orthodontic conditions being treated by the survey group and the type of appliances and techniques they were using.

Table I-XI show the responses of general practitioners and pediatric dentists to the different sections of the questionnaire. Statistical analysis of the data was done using the Statistical Package for the Social Sciences[39] to investigate the differences between pediatric dentists and general dentists as well as the influence of other key variables. T-test and Chi square analyses[40] were done to determine if any significant differences existed.

Chi square analysis was done to compare the type of orthodontic procedures being performed by pediatric dentists and general practitioners and the type of appliances being used by each group. As illustrated in Table XII, pediatric dentists treated significantly more orthodontic conditions and used all but one of the orthodontic appliances and techniques significantly more frequently ($p<0.001$).

A Chi square analysis was also done to determine if a significant difference existed between general practitioners and pediatric dentists with respect to continuing education in orthodontics (Table IX). In the pediatric dentist group, 93.9 percent indicated that they had taken courses in orthodontics, and 58.0 percent of the general practitioners indicated that they had done so. The calculated X^2 value was 29.66 which was highly significant for one degree of freedom ($p<0.001$).

A t-test analysis was done to compare the attitudes of general practitioners and pediatric dentists with regard to their undergraduate dental education in orthodontics (Table XIII). A significant difference existed between the attitudes of general practitioners and pediatric dentists ($p<0.05$). Significantly more pediatric dentists either disagreed

or strongly disagreed with the statement about the adequacy of undergraduate dental school education in orthodontics.

Table XIV reveals the results of Chi square analyses which determined if a significant difference existed between general practitioners and pediatric dentists with respect to the percentage of time spent on orthodontic treatment and trends observed in restorative and orthodontic services in their offices. Pediatric dentists spent significantly more time ($p<0.001$) providing orthodontic services in their offices than did general practitioners. Also pediatric dentists saw a significantly reduced demand ($p<0.01$) for restorative services in their offices as compared to general practitioners and spent significantly more time ($p<0.001$) on orthodontics as compared to general practitioners over the past few years.

Chi square analyses were done to determine the effects of age on various key variables.

Age of participant was not significant ($p>0.05$) with respect to the type of orthodontic conditions treated and the type of orthodontic appliances and techniques used by the total group. Age was also not significant ($p>0.05$) with respect to the percentage of time spent on orthodontics by the total group. The calculated X^2 value was 19.3 with 16 degrees of freedom, which was not significant at the 0.05 level. However, age was found to be significant ($p<0.01$) with respect to both the time spent on orthodontic services and the time spent on restorative services over the last few years in practice. The calculated X^2 value for age versus the time spent on restorative and operative services

during the last few years was 82.15 with 12 degrees of freedom, which was significant at the 0.01 level. The older groups (greater than 40 years of age) saw a more significant decrease in the time spent on routine operative and restorative procedures in the past few years (Table XV).

Table XVI represents the total test group with respect to age versus trends in orthodontic services over the past few years. The calculated value of X^2 for age versus trends in orthodontic services was 24.92, which was significant for 8 degrees of freedom ($p<0.01$). A significant number of the practitioners (less than 40 years of age) spent an increased amount of time on orthodontics over the past few years.

Statistical analysis was then done to determine the significance of population on the various parameters studied. Population was defined as the population of the community in which the responding dentist practiced. No significant difference was found by the Chi square analysis to exist between the population subgroups with respect to the trends seen in the time spent on restorative and operative procedures and on orthodontic procedures in the past few years.

Table XVII shows that a significant difference between the population subgroups did exist with respect to the amount of time currently spent on orthodontic procedures. From the Chi square analysis it appears that practitioners in the population subgroup 5,000-25,000 spent significantly more time ($p<0.01$) in their practices providing orthodontic services.

Of the list of orthodontic conditions treated and the appliances and techniques used, only four were found to be significant within the four population subgroups (Table XVIII). A significant difference ($p<0.01$) was found between the population subgroups with respect to the treatment of anterior crossbites and the use of space maintenance. Practitioners in the greater than 100,000 subgroup tended to treat anterior crossbites and use space maintenance significantly less than practitioners in the other subgroups.

A significant difference ($p<0.05$) was also found between the population subgroups with respect to the treatment of comprehensive orthodontic cases and the use of band and loop space maintainers. In the greater than 100,000 subgroup, practitioners treated fewer comprehensive orthodontic cases. Practitioners in the 25,000-100,000 subgroup and the 5,000-25,000 people subgroup used significantly more band and loop space maintainers than practitioners in other population subgroups.

The significance of continuing education courses in orthodontics in the total test group was also investigated. Both age of practitioner and the population of practice location were not significant ($p>0.05$) with respect to continuing education in orthodontics (Table XIX).

As shown in Table XX, continuing education in orthodontics was found to be highly significant ($p<0.001$) with respect to the type of orthodontic conditions treated and the type of orthodontic appliances and techniques used in practice.

Continuing education in orthodontics also significantly ($p<0.001$) affected the percentage of time spent on orthodontics and the trend

of time spent providing orthodontic services over the past few years (Table XXI).

Continuing education in orthodontics, however, was not significant with respect to the trends seen in the past few years for time spent providing routine operative and restorative care.

TABLES

TABLE I

Distribution of general practitioners in Indiana

Dental District	% of Indiana Dentists	Number Surveyed
1. Northwest	12.27	62
2. North Central	9.79	49
3. Isaac Knapp	9.12	46
4. West Central	3.68	18
5. Wabash Valley	5.00	25
6. Ben Hur	2.23	11
7. East Central	5.77	29
8. Western Indiana	3.32	16
9. Indianapolis	28.15	140
10. Eastern Indiana	2.27	11
11. Greene District	1.25	6
12. First District	7.61	38
13. South Central	6.10	32
14. Southeastern	3.44	17
	100.00	500

TABLE II

Age distribution of responding pediatric dentists and general practitioners

Age	Pediatric Dentists		General Practitioners	
	number	percent	number	percent
<30	3	4.5	9	2.5
30-39	20	30.3	192	52.7
40-49	23	34.8	119	32.7
50-59	14	21.2	41	11.3
>59	6	9.1	3	0.8
Total	66	100.0	364	100.0

TABLE III

Population of community in which practice is located, with distribution of pediatric dentists and general dentists

Population of community	Pediatric Dentists		General Practitioners	
	number	percent	number	percent
>100,000	29	43.9	139	38.2
25,000 - 100,000	27	40.9	72	19.8
5,000 - 25,000	9	13.6	110	30.2
<5,000	1	1.5	43	11.8
Total	66	100.0	364	100.0

TABLE IV

Distribution of responding general practitioners within the fourteen dental districts of Indiana

District	Number surveyed	Number returned	Percent returned	Percent of total returned
North West	62	38	61.29	10.4
North Central	49	38	77.55	10.4
Isaac Knapp	46	36	78.26	9.9
West Central	18	13	72.22	3.6
Wabash Valley	25	17	68.00	4.7
Ben Hur	11	6	54.55	1.6
East Central	29	15	51.72	4.1
Western Indiana	16	13	81.25	3.6
Indianapolis	140	108	77.14	29.7
Eastern Indiana	11	9	81.82	2.5
Greene District	6	5	83.33	1.4
First District	38	32	84.21	8.8
South Central	32	22	68.75	6.0
South Eastern	17	12	70.59	3.3
Total	500	364	-	100.0

TABLE V

Distribution of general practitioners and pediatric dentists with respect to year of graduation from dental school

Year of dental school graduation	Pediatric Dentists:		General Practitioner:	
	Number	Percent	Number	Percent
Prior to 1965	21	31.8	91	25.0
1966 - 1975	30	45.5	142	39.0
1976 - 1985	15	22.7	131	36.0
Total	66	100.0	364	100.0

TABLE VI

Distribution of pediatric dentists with respect to year of completion of postgraduate specialty training

Year of completion of specialty training	Pediatric Dentists	
	Number	Percent
Prior to 1965	15	22.7
1966 - 1975	30	45.5
1976 - 1985	21	31.8
Total	66	100.0

TABLE VII

Specialty qualifications of responding pediatric dentists

Qualifications	Number of pediatric dentists	Percent of pediatric dentists
Certificate	52	78.8
Masters & Certificate	14	21.2
Total	66	100.0

TABLE VIII

Perceptions of general practitioners and pediatric dentists with respect to the adequacy of their undergraduate and postgraduate dental education in orthodontics

Undergraduate	Pediatric Dentists:		General Practitioners:	
Education	Number	Percent	Number	Percent
Strongly Agree	0	0	3	0.8
Agree	0	0	20	5.5
Disagree	17	25.8	117	32.1
Strongly Disagree	49	74.2	220	60.4
Total	66	100.0	360	100.0

Postgraduate	Number	Percent
Education	Pediatric Dentists	Pediatric Dentists
Strongly Agree	3	4.5
Agree	9	13.6
Disagree	30	45.5
Strongly Disagree	22	33.3
Total	66	100.0

TABLE IX

Distribution and type of continuing education courses taken by pediatric dentists and general practitioners

Continuing	Pediatric Dentists:		General Practitioners:	
Education	Number	Percent	Number	Percent
Yes	62	93.9	211	58.0
No	4	6.1	153	42.0
Short Courses	27	40.9	151	41.5
Comprehensive	12	18.2	27	7.4
Both	34	36.4	33	9.1

TABLE X

Distributions of pediatric dentists and general practitioners with respect to percentage of practice time spent on orthodontics, and trends in time spent on restorative procedures and orthodontics procedures

		Pediatric Dentists:		General Practitioners:	
		Number	Percent	Number	Percent
A. Restorative:	Increase	7	10.6	81	22.3
Services	No change	17	25.8	133	36.5
	Decrease	42	63.6	149	40.9
		66	100.0	364	100.0
B. Orthodontic:	Increase	49	74.2	109	29.9
Services	No change	14	21.2	206	56.6
	Decrease	3	4.5	49	13.5
		66	100.0	364	100.0
C. Percentage of time spent on orthodontics:					
	None	1	1.5	89	24.5
	<10%	23	34.8	225	61.8
	10-25%	20	30.3	45	12.4
	25-50%	16	24.2	3	0.8
	>50%	6	9.1	2	0.5
		66	100.0	364	100.0

TABLE XI

Type of orthodontic conditions treated and type of orthodontic appliances and techniques used by pediatric dentists and general practitioners (positive responses only)

	Pediatric Dentists:		General Practitioners:	
	Number	Percent	Number	Percent
Orthodontic Conditions:				
Anterior crossbite	63	95.5	190	52.5
Posterior crossbite	62	93.9	135	37.1
Space maintenance	66	100.0	308	84.6
Ectopic molars	64	97.0	104	28.6
Thumb habits	62	93.9	138	37.9
Tongue habits	56	84.8	107	29.4
Space regaining	58	87.9	129	35.4
Incisor alignment	56	84.8	148	40.7
Serial extractions	46	69.7	166	45.6
Skeletal malocclusions	53	80.3	84	23.1
Comprehensive cases	41	62.1	65	17.9
Appliances & Techniques:				
Band and loop	65	98.5	304	83.5
Lingual arch	63	95.5	262	72.0
Hawley appliance	53	80.3	217	59.6
Lingual arch - springs	51	77.3	102	28.0
Arch expansion appliances	57	86.4	76	20.9
Palatal jackscrew	55	83.3	95	26.1
2 X 4 appliance	51	77.3	85	23.4
Headgear	37	56.1	37	10.2
Sectional archwire	38	57.6	59	16.2
Removable arch expansion	43	65.2	95	26.1
Functional appliances	49	74.2	106	29.1
Straight wire technique	44	66.7	84	23.1
Edgewise technique	20	30.3	21	5.8
Begg technique	0	0.0	3	0.8

TABLE XII

Chi square comparison of pediatric dentists and general practitioners with respect to the type of conditions treated and the type of appliances and techniques used

	Percent Positive Responses: Pediatric Dentists	General Dentists	X^2	Level
Anterior crossbite	95.3	52.2	41.40	0.001
Posterior crossbite	93.9	37.1	70.47	0.001
Space maintenance	100.0	84.6	10.36	0.001
Ectopic molars	97.0	28.6	106.94	0.001
Thumb habits	93.9	37.9	68.26	0.001
Tongue thrusts	84.8	29.4	70.65	0.001
Space regaining	87.9	35.4	60.40	0.001
Incisor alignment	84.8	40.7	42.00	0.001
Serial extraction	69.7	45.6	12.03	0.001
Skeletal malocclusion	80.3	23.1	81.67	0.001
Comprehensive cases	62.1	17.9	56.57	0.001
Band and loop	98.5	83.5	9.09	0.01
Lingual arch	95.5	72.0	15.44	0.001
Hawley	80.3	59.6	9.37	0.01
Lingual arch-springs	77.3	28.0	57.00	0.001
Arch expansion	86.4	20.9	109.10	0.001
Palatal jackscrew	83.3	26.1	78.07	0.001
2 X 4 appliance	77.3	23.4	72.66	0.001
Headgear	56.1	10.2	79.40	0.001
Sectional archwire	57.6	16.2	52.39	0.001
Removable expanders	65.2	26.1	37.33	0.001
Functional appliance	74.2	29.1	47.40	0.001
Straight wire technique	66.7	23.1	48.71	0.001
Edgewise technique	30.3	5.8	36.19	0.001
Begg technique	0.0	0.8	0.00	-

At 1 degree of freedom: X^2_2 (.05) = 3.84
X^2_2 (.01) = 6.64
X^2 (.001)= 10.83

TABLE XIII

T-test comparison of attitudes of general dentists and pediatric dentists toward their undergraduate dental education in orthodontics

	Strongly Agree	Agree	Disagree	Strongly Disagree	Mean	Standard Deviation
Pediatric Dentists:	0	0	17	49	3.742	.441
General Dentists:	3	20	117	220	3.599	.855

*significant difference for 400 degree of freedom at 0.05 level

TABLE XIV

Results of Chi square analysis between pediatric dentists and general practitioners with regard to percentage of time spent on orthodontics, and trends in time spent on restorative procedures and on orthodontic procedures

	X^2	Degrees of Freedom	Level
Restorative Services	12.23	3	0.01
Orthodontic Services	47.18	2	0.001
Percent Orthodontics	124.23	4	0.001

TABLE XV

Chi square analysis of age subgroups for total test group with respect to trends seen in time spent on routine operative and restorative services

Age	Increase		No Change		Decrease	
	number	percent	number	percent	number	percent
<30	2	16.7	10	83.3	0	0
30-39	65	30.7	89	42.0	57	26.9
40-49	14	9.9	40	28.2	88	62.0
50-59	6	10.9	10	18.2	39	70.9
>60	1	11.1	1	11.1	7	77.8

*Calculated X^2 = 82.15 which is significant at 0.01 level

TABLE XVI

Chi square analysis of age subgroups of total test group with respect to trends in time spent providing orthodontic services over the past few years

Age	Increase		No Change		Decrease	
	Number	Percent	Number	Percent	Number	Percent
< 30	9	75.0	3	25.0	0	0
30-39	87	41.0	108	50.9	17	8.0
40-49	46	32.4	77	54.2	19	13.4
50-59	14	25.5	28	50.9	13	23.6
> 60	2	22.2	4	44.4	3	33.4

*Calculated Chi square value = 24.92, which is significant at 0.01 level

TABLE XVII

Chi square analysis of population subgroups of total test group with respect to percentage of time spent providing orthodontic services

Percentage of Time	>100,000	25,000 -100,000	5,000 -25,000	<5,000
None	52 (31.0%)	21 (21.2%)	11 (9.2%)	6 (13.6%)
<10	85 (50.6%)	52 (52.5%)	85 (71.4%)	26 (59.1%)
10 - 25	20 (11.9%)	17 (17.2%)	17 (14.3%)	11 (25.0%)
25 - 50	9 (5.4%)	8 (8.1%)	2 (1.7%)	0 (0.0%)
>50	2 (1.2%)	1 (1.0%)	4 (3.4%)	1 (2.3%)
Total	168 (100%)	99 (100%)	119 (100%)	44 (100%)

Calculated X^2 = 36.67 with 12 degrees of freedom

At 0.01 level, X^2 = 26.22 with 12 degrees of freedom

TABLE XVIII

Chi square analysis of population subgroups with respect to the use of band and loop appliances and the treatment of comprehensive orthodontic cases, anterior crossbites and space maintenance

	>100,000	100,000 -25,000	25,000 -5,000	<5,000	X^2
Anterior Crossbite:					
Yes	84 (50%)	58 (58.6%)	79 (66.4%)	32 (72.7%)	
No	84 (50%)	41 (41.4%)	40 (33.6%)	12 (27.3%)	11.73
Space Maintenance:					
Yes	134 (79.8%)	90 (90.9%)	110 (92.4%)	40 (90.9%)	
No	34 (20.2%)	9 (9.1%)	9 (7.6%)	4 (9.1%)	12.80
Comprehensive:					
Yes	30 (17.9%)	25 (25.3%)	39 (32.8%)	12 (27.3%)	
No	138 (82.1%)	74 (74.7%)	80 (67.2%)	32 (72.7%)	8.58
Band & Loop:					
Yes	135 (80.4%)	90 (90.9%)	108 (90.8%)	36 (81.8%)	
No	33 (19.6%)	9 (9.1%)	11 (9.2%)	8 (18.2%)	9.19

X^2 with 3 degrees of freedom = 7.82 (0.05 level)

X^2 with 3 degrees of freedom = 11.34 (0.01 level)

TABLE XIX

X^2 analysis of the effect of age and population of the community where practice is located on continuing education in orthodontics

Variable	Continuing Education Courses: Yes	No	X^2
A. Age:			
<30	9 (75.0%)	3 (25.0%)	
30-39	133 (62.7%)	79 (37.3%)	
40-49	86 (60.6%)	56 (39.4%)	4.11*
50-59	37 (67.3%)	18 (32.7%)	
>60	8 (88.9%)	1 (11.1%)	
Total	273 (63.5%)	157 (36.5%)	
B. Population:			
>100,000	95 (56.5%)	73 (43.5%)	
25-100,000	67 (67.7%)	32 (32.3%)	
5-25,000	81 (68.1%)	38 (31.9%)	5.74+
<5,000	30 (68.2%)	14 (31.8%)	
Total	273 (63.5%)	157 (36.5%)	

* X^2 with 4 degrees of freedom = 9.49 (0.05 level)

+ X^2 with 3 degrees of freedom = 7.82 (0.05 level)

TABLE XX

Effect of continuing education on the type of orthodontic conditions treated and the type of appliances and techniques used (positive responses only indicated)

	Continuing Education			
	% Yes	% No	X^2	Level of significance
Conditions:				
Anterior crossbite	76.6	28.0	94.94	0.001
Posterior crossbite	65.6	11.5	115.36	0.001
Space maintenance	93.4	75.8	25.76	0.001
Ectopic molars	53.8	13.4	66.89	0.001
Thumb habit	64.8	14.6	98.90	0.001
Tongue thrust	53.8	10.2	78.86	0.001
Space regaining	61.9	11.5	101.15	0.001
Incisor alignment	64.1	18.5	81.42	0.001
Serial extraction	51.3	45.9	0.97	-
Skeletal malocclusion	49.8	0.6	108.80	0.001
Comprehensive cases	38.8	0.0	78.83	0.001
Appliances & techniques:				
Band and loop	90.8	77.1	14.42	0.001
Lingual arch	86.4	56.7	46.23	0.001
Hawley	77.7	36.9	68.89	0.001
Lingual arch-springs	49.1	12.1	57.87	0.001
Arch expansion	46.9	3.2	87.07	0.001
Jackscrew	51.6	5.7	90.50	0.001
2 X 4 appliance	49.1	1.3	103.16	0.001
Headgear	27.1	0.0	49.52	0.001
Sectional archwire	34.8	1.3	64.22	0.001
Removable expander	48.4	3.8	88.66	0.001
Functional appliances	55.7	1.9	122.67	0.001
Straight wire	46.9	0.0	102.58	0.001
Edgewise technique	15.0	0.0	24.35	0.001
Begg technique	1.1	0.0	0.51	-

Example: 76.6% of practitioners who had taken continuing education treated anterior crossbites while 28% who had not taken continuing education also treated anterior crossbites.

At 1 degree of freedom, X^2 (0.001) = 10.83

TABLE XXI

Effect of continuing education on percentage of time spent providing orthodontic treatment and trend in time spent providing orthodontic services in the past few years

	Continuing Education		
	Yes	No	X^2
A. Percent:			
None	33 (12.1%)	57 (36.3%)	
<10%	149 (54.6%)	99 (63.1%)	
10-25%	64 (23.4%)	1 (0.6%)	78.99*
25-50%	19 (7.0%)	0 (0.0%)	
>50%	8 (2.9%)	0 (0.0%)	
Total	273 (100%)	157 (100%)	
B. Trend:			
Increase	147 (53.8%)	11 (7.0%)	
No Change	92 (33.7%)	128 (81.5%)	104.16+
Decrease	34 (12.5%)	18 (11.5%)	
Total	273 (100%)	157 (100%)	

* X^2 at 4 degrees of freedom = 18.47 (0.001 level)

+ X^2 at 2 degrees of freedom = 13.82 (0.001 level)

TABLE XXII

Comparison of current study and 1981 Association of Pedodontic Diplomates study with regard to type of conditions treated and type of appliances and techniques used

	% Indiana Pediatric Dentists	% Diplomates
Conditions:		
Anterior crossbite	95.5	96.0
Posterior crossbite	93.9	94.0
Space maintenance	100.0	96.0
Ectopic molars	97.0	95.0
Thumb habits	93.9	90.0
Tongue thrust	84.8	69.0
Space regaining	87.9	79.0
Incisor alignment	84.8	74.0
Serial extractions	69.7	59.0
Skeletal malocclusions	80.3	41.0
Comprehensive cases	62.1	33.0
Appliances & techniques:		
Band and loop	98.5	82.0
Lingual arch	95.5	91.0
Hawley	80.3	84.0
Lingual arch-springs	77.3	68.0
Arch expansion appliances	86.4	78.0
Palatal jackscrew	83.3	67.0
2 X 4 appliance	77.3	55.0
Headgear	56.1	52.0
Sectional archwire	57.6	51.0
Removable expanders	65.2	44.0
Functional appliances	74.2	33.0
Straight wire technique	66.7	28.0
Edgewise technique	30.3	23.0

Only positive responses are indicated above

DISCUSSION

The response to this survey was within an acceptable range for forming conclusions. The number of responding pediatric dentists (92.5 percent) was a representative sample of the total group surveyed. The 76.96 percent response from general practitioners fell slightly below the 80 percent return rate quoted in other surveys[34,35] but is considered representative. Also, the response was much better than the 73% response reported by the Association of Pedodontic Diplomates.[9] The rate of return reported by Miranda[10] in a survey of pediatric dentists was 80%, considerably lower than in the current survey.

The high response rate could be attributable to a number of factors: the survey topic is a current concern of Indiana general practitioners and pediatric dentists, a self-addressed stamped return envelope was used, the questionnaire was brief and easy to complete, the population being surveyed was a group of professionals, and the cover letters were personalized with each dentist's name. In past surveys, these factors have been shown by psychologists[33,34] to increase the response rate.

The response by pediatric dentists was greater than that of general practitioners. The survey may have been of more topical concern among the pediatric dentists than the general practitioners. It was also conducted by a graduate student in pediatric dentistry which may have stimulated a greater response in the pediatric dentist group.

The results of this study differed greatly from previous surveys which investigated orthodontic services being provided by pediatric dentists. The 1981 survey of the Association of Pedodontic Diplomates[9] found that 33 percent of the Diplomates provided some comprehensive orthodontic services. Positive responses for other conditions treated, and appliances and techniques used by the Diplomates were as follows: early treatment of skeletal malocclusions (41 percent), functional appliances (33 percent), straight wire technique (23 percent) and comprehensive edgewise technique (23 percent). About 44 percent of the Diplomates who responded stated that they devoted less than 10 percent of their time providing orthodontic services. In the current Indiana study of pediatric dentists, 62.1 percent of the responding pediatric dentists stated that they provided some comprehensive orthodontic services. Indiana pediatric dentists also had a higher positive response rate for the following: early treatment of skeletal malocclusions (80.3 percent), functional appliances (74.2 percent), straight wire technique (66.7 percent) and comprehensive edgewise technique (30.3 percent). Likewise, with regard to time spent providing orthodontic services, 35 percent of Indiana pediatric dentists responded that this occupied less than 10 percent of their practice time.

Comparison of the current study to the survey of the Association of Pedodontic Diplomates[9] (Table XXII) shows that Indiana pediatric dentists are doing more comprehensive orthodontic procedures and more of their practice time is being devoted to providing this orthodontic treatment. In the current study 74.2 percent of Indiana pediatric

dentists saw an increase in the amount of time they spent providing orthodontic treatment in the past few years. In comparison 48 percent of the Diplomates saw a similar increase in 1981.

The 1980 survey of the Southwestern Society of Pedodontists[10] concluded that 25 percent of the responding members were providing comprehensive orthodontic treatment at that time. The same survey showed that approximately 60 percent of the group provided preventive - interceptive treatment. In comparison, the current Indiana study showed that 62.1 percent of the pediatric dentists provided comprehensive orthodontic treatment, and over 75 percent offered preventive - interceptive treatment.

A 1977 North Carolina survey[11] showed that pediatric dentists devoted less than 8 percent of their practice time to any type of orthodontic procedure. In comparison, 65 percent of the current study group of pediatric dentists said they spend more than 10 percent of their time providing orthodontic services.

The current study is one of the few investigations of the extent of orthodontic services being provided by general practitioners. The 1980 survey of Chicago general practitioners[14] found that treatment by the general practitioners was limited to minor orthodontic procedures such as observation, tooth guidance and minor tooth movement. More complex orthodontic cases were not treated by the group. The current Indiana study found very different results. Of the responding general practitioners in the state, 17.9 percent stated they treated comprehensive orthodontic cases, 29.1 percent used functional appliances, and 23.1

percent used straight wire techniques to treat comprehensive orthodontic cases. A majority of the general practitioners in Indiana also provided preventive - interceptive services.

This study shows that pediatric dentists as well as general dentists in Indiana are providing more comprehensive orthodontic services and are spending more time doing so than has been reported in relatively recent studies. This trend in increased orthodontic services can be due to a number of situations that are currently affecting modern dentistry. The declining national caries rate,[2] declining Indiana caries rate,[1] declining birthrate,[4] and increasing number of dentists[6,7] have been used to explain a decrease in the public need for routine operative and restorative services. Meskin[8] concluded that one way in which pediatric dentists could stop this decrease would be to offer more sophisticated services, especially as comprehensive orthodontics. The current study supports this concept by showing that both pediatric dentists and general practitioners are offering significantly more comprehensive orthodontic services than in previous studies. Undoubtedly these factors and economic pressure have had a role in forcing some pediatric dentists and general practitioners to provide such services. Other practitioners may be driven by their professional desire to learn new techniques as part of their continuing education.

The current study also attempted to quantify the amount of orthodontics being done by both pediatric dentists and general practitioners and identify the type of procedures being provided by each group. Only limited surveys[13,14] have been done in the past to identify trends

in orthodontic services provided by general practitioners. No real comparison of orthodontic services provided by general practitioners and pediatric dentists has been done in the past.

This study shows that pediatric dentists provide significantly more comprehensive orthodontic treatment than do general practitioners in Indiana. Indiana pediatric dentists also provide significantly more interceptive - preventive orthodontic treatment. These results are to be expected since pediatric dentists usually have more educational exposure to orthodontics through their training in growth and development, and biomechanics.

Pediatric dentists in the study also spent significantly more time providing orthodontic treatment than did general practitioners. Pediatric dentists also saw a more significant reduction in the need for routine operative and restorative procedures than did general practitioners. These observations may be due to the fact that pediatric dentists are affected more by the declining caries rate and birth rate than are general practitioners. Pediatric dentists may be seeing fewer patients with caries due to widespread preventive programs, like water fluoridation, that are more effective in the developing dentition. However, the reduced public need for restorative and operative care may be allowing both general practitioners and pediatric dentists to spend more time on a phase of dentistry which was neglected in the past, except for obvious severe cases.

This study also investigated the effect of age on the amount and type of orthodontic services being provided by general practitioners and pediatric dentists. The trend of increasing orthodontic services

was not confined to one age group. Age was not a significant factor in the type of orthodontic conditions treated or the type of appliances and techniques used. However, the older practitioners (over 40 years of age) did see a greater decrease in the need for restorative and operative procedures. At the same time, the under-50 group saw a more significant increase in the time they were spending providing orthodontic services in the past years.

These results dispell the idea that younger practitioners are providing most of the increased orthodontic services by general practitioners and pediatric dentists. The older practitioners are seeing reduced need for operative and restorative services as compared to what they saw in the 1960's and 1970's. Younger practitioners may have never seen restorative needs comparable to those decades and are less aware of declining restorative needs. Undoubtedly the decrease in the public need for routine operative and restorative services has led to the increase in time spent on other services like orthodontics.

Population was also investigated as a variable, to determine if any of the trends seen could be correlated to population. Practitioners who practiced in communities of 5,000 - 25,000 population spent significantly more time providing orthodontic services. This finding may be due to the fact that smaller communities tend to have few orthodontists, or none. As a result, general practitioners or pediatric dentists must provide the treatment or refer the patients who require treatment to larger centers. This idea also may explain the finding that significantly fewer practitioners in communities larger than 100,000 provide

comprehensive orthodontic treatment. In these communities, orthodontists are more readily available and referrals do not mean an increase in distance traveled for the patient.

The effect of continuing education in orthodontics was also investigated to determine its significance. Of the total survey group, 63.6 percent reported having taken continuing education courses in orthodontics. No age or population subgroup dominated. Continuing education participants, however, were found to spend significantly more time providing orthodontic services than non-participants. It was reassuring to find that of the practitioners who had not taken continuing education courses in orthodontics, none provided comprehensive or advanced orthodontic treatment to their patients. They tended to provide significantly less sophisticated orthodontic services; even in the realm of preventive - interceptive orthodontics.

Even though a majority of practitioners were found to have taken continuing education courses in orthodontics and as result offered more sophisticated treatment alternatives to their patients, this survey was not designed to identify the adequacy of these courses.

Most of the additional comments written in by the practitioners (Appendix 4) stated that they found undergraduate dental school training lacking in orthodontic instruction. Of the respondents, 93 percent either disagreed or strongly disagreed with the statement that undergraduate dental school training adequately prepared them to deal with orthodontic problems. Dental schools should alter their curricula to meet the American Dental Association guidelines for teaching orthodontics.[21] There is an obvious need for more orthodontic instruction among general

practitioners and pediatric dentists, as indicated by the high percentage of practitioners who have taken continuing education courses to meet the demands of their practices. Dental school curricula should provide the basics of orthodontics which allow new graduates to function adequately in private practice. Continuing education courses must also be a means by which practitioners learn new techniques, and are exposed to new ideas, in a rapidly changing and complex profession.

Several recommendations can be proposed as a result of this investigation.

1) Similar studies should be done in other sections of the country to determine if the trends in Indiana also exist nationwide.
2) A follow-up study should be done in Indiana in approximately five years to determine if currently observed trends continue in the future.
3) Dental schools, both at the undergraduate and postgraduate pediatric dental levels, should offer more comprehensive orthodontic training in light of the results of this study. The majority of the practitioners stated that their undergraduate training in orthodontics was inadequate. The majority also tried to overcome these inadequacies by attending continuing education courses.
4) A study could also be done comparing the types of orthodontic procedures used by orthodontists and pediatric dentists.

SUMMARY AND CONCLUSIONS

This study investigated the extent of orthodontic treatment being provided by pediatric dentists and general practitioners in the state of Indiana. The survey instrument was a two-page questionnaire that was mailed to 571 dentists, including all 71 Indiana pediatric dentists who practice primarily in a private practice setting. The remainder of the study group consisted of 500 general practitioners who were selected on the basis of year of graduation from dental school, age, geographic location and size of community in which they practiced.

Seventy-eight percent of the questionnaires mailed were completed and returned; these respondents included 92.95 percent of the pediatric dentists and 76.96 percent of the general practitioners.

According to the survey, 62.1 percent of the pediatric dentists and 17.9 percent of the general practitioners provide comprehensive orthodontic treatment. These results are remarkably higher than results from previous surveys done in the early 1980's. The Association of Pedodontic Diplomates[9] found that 33 percent of its members provided comprehensive orthodontic treatment while only 25 percent of the surveyed members of the Southwestern Society of Pedodontists[10] provided comprehensive treatment. A 1980 survey of Chicago general practitioners[14] showed that none of the survey group provided comprehensive treatment.

As expected, this study showed that a greater percentage of pediatric dentists (62.1 percent) provide significantly more comprehensive orthodontic treatment than do general practitioners (17.9 percent) in Indiana.

Pediatric dentists also were found to spend significantly more of their practice time providing orthodontic services as compared to general practitioners.

Age of practitioner was found not to significantly affect the percentage of time spent providing orthodontic services, the orthodontic conditions treated, or the type of appliances and techniques used. As a result, it was shown that the current trend in increased orthodontic services provided by pediatric dentists and general practitioners was not confined to any one age group of practitioners.

The population of the community in which the practitioner practiced significantly affected the type of orthodontic services provided. Fewer practitioners in communities of greater than 100,000 people provide comprehensive orthodontics. At the same time practitioners who practice in 5,000 - 25,000 people communities spend significantly more time providing orthodontic services. In the large cities the public as well as the general practitioners and pediatric dentists have easier access to referral and treatment by orthodontists. In the smaller communities general practitioners may feel obligated to provide orthodontic services to patients who do not have easy access to orthodontists.

Continuing education was found to have a significant affect upon all parameters studied. In the study group, 63.5 percent of the practitioners have taken some type of continuing education courses in orthodontics. Practitioners who have taken continuing education courses spend significantly more time providing orthodontic treatment and provided significantly more types of orthodontics, ranging from preventive to comprehensive treatment.

An overwhelming majority of the practitioners surveyed stated they found their undergraduate dental school training in orthodontics to be less than adequate in preparing them for private practice. Most of the additional written comments echoed this inadequacy. In light of this response, the trends observed and the increased desire for continuing education in orthodontics by general practitioners and pediatric dentists; dental school curricula should address this changing mode of modern dentistry.

Recommendations growing out of this study include the following: similar studies in other regions, modification of dental school curricula to include more orthodontic instruction in undergraduate dental education and postgraduate pediatric dentistry, and a follow-up study in five years to investigate the trends observed over the period.

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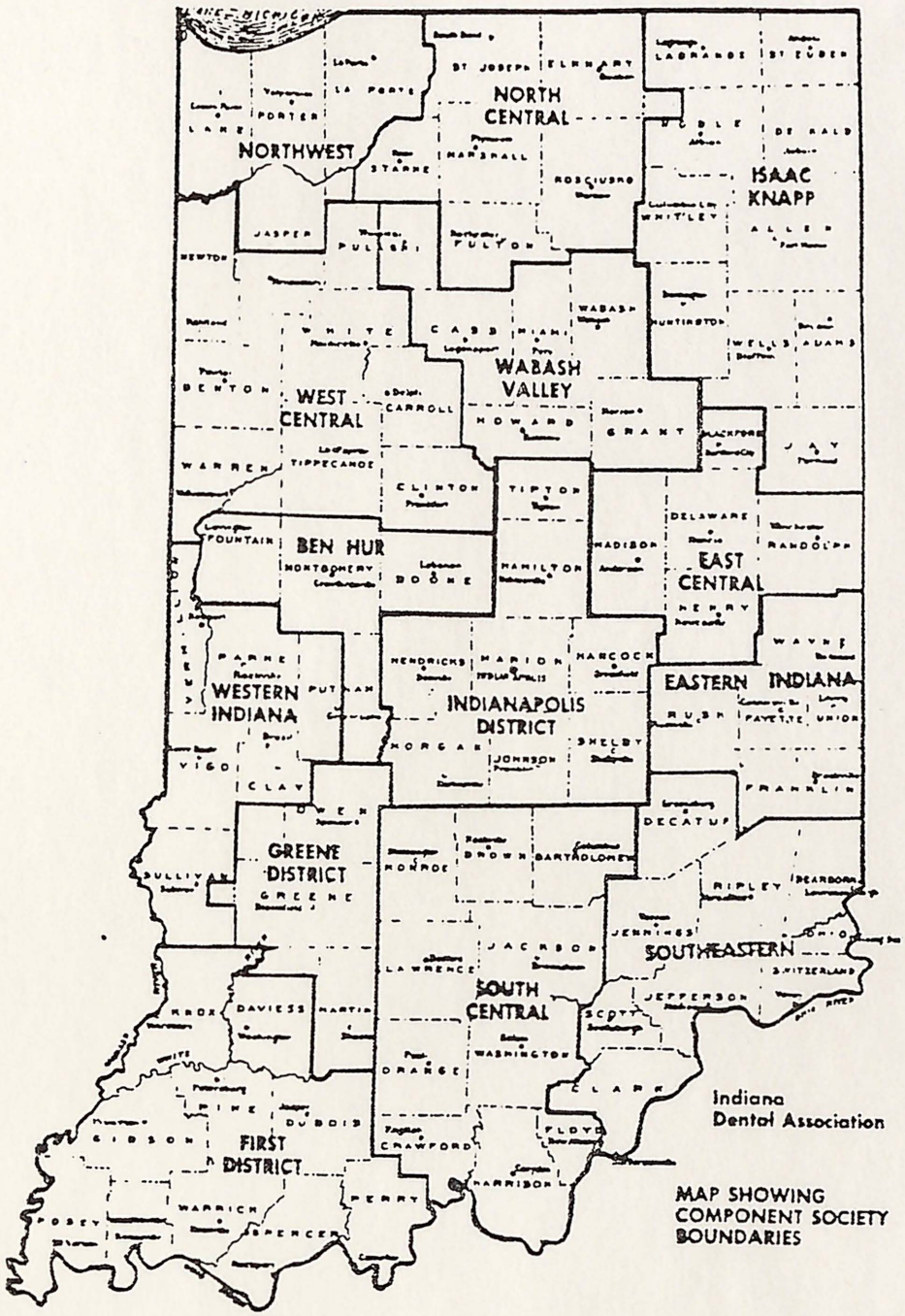
APPENDIXES

APPENDIX 1


NORTH CENTRAL
NORTHWEST
ISAAC KNAPP
WABASH VALLEY
WEST CENTRAL
BEN HUR
EAST CENTRAL
WESTERN INDIANA
INDIANAPOLIS DISTRICT
EASTERN INDIANA
GREENE DISTRICT
SOUTHEASTERN
SOUTH CENTRAL
FIRST DISTRICT
Indiana Dental Association
MAP SHOWING COMPONENT SOCIETY BOUNDARIES

APPENDIX 2

SURVEY QUESTIONNAIRE

1. Age: less than 30 _____
30 - 39 _____
40 - 49 _____
50 - 59 _____
more than 59 _____

Population of community practice located in:

greater than 100,000 _____
25 - 100,000 _____
5 - 25,000 _____
less than 5,000 _____

2. Year of graduation from:

Dental school _____
Postgraduate training _____

3. Graduate Dentistry Qualifications (if applicable):

Certificate alone _____
Masters degree with certificate _____

4. Orthodontic Education:

a. Your undergraduate dental school training adequately prepared you to recognize and treat patient's orthodontic needs effectively.

Strongly Agree	Agree	Disagree	Strongly Disagree
_____	_____	_____	_____

b. Your postgraduate dental training adequately prepared you to recognize and treat patient's orthodontic needs effectively.

Strongly Agree	Agree	Disagree	Strongly Disagree
_____	_____	_____	_____

c. Have you attended continuing education courses which dealt with orthodontics:

Yes _____
No _____

If yes, what type of courses were these?

Short courses (weekend) _____
1-2 year comprehensive course _____

d. After taking orthodontic continuing education courses, the number of patients you refer to orthodontists has:

Increased	Remained the same	Decreased
_____	_____	_____

5. a. The need for routine operative and restorative services in your practice has in the past years:

Decreased	Remained the same	Increased
_____	_____	_____

b. Time spent on orthodontic procedures in your office over the last few years has:

Decreased	Remained the same	Increased
_____	_____	_____

c. Currently what percentage of your time is spent providing orthodontic treatment (estimate):

- none _____
- < 10% _____
- 10-25% _____
- 25-50% _____
- > 50% _____

6. Type of orthodontic conditions treated in your office (check all that may apply):

Anterior crossbites _____
Posterior crossbites _____
Space maintenance _____
Ectopic first molars _____
Thumb sucking habits _____
Tongue thrust habits _____
Space regaining _____
Incisor alignment _____
Serial extractions _____
Early treatment of skeletal malocclusions _____
Comprehensive orthodontic cases _____

7. Type of orthodontic appliances used in your treatment plans (check all that may apply):

Band and loop _____
Lingual holding arches _____
Removable Hawley with auxilary springs _____
Lingual arches with auxilary springs _____
Arch expansion appliances (w-arch or quad-helix) _____
Palatal jackscrew appliance _____
2 X 4 banding (or brackets) _____
Headgear _____
Fixed sectional arch wire appliance _____
Removable arch expansion appliance _____
Functional appliances _____
Straight wire technique _____
Comprehensive orthodontic treatment edgewise technique _____
Comprehensive orthodontic treatment Begg technique _____

8. Additional Comments:

APPENDIX 3

INDIANA UNIVERSITY
SCHOOL OF DENTISTRY
1121 West Michigan Street
Indianapolis, Indiana 46202

February 21, 1986

I am a postgraduate student at Indiana University School of Dentistry, specializing in Pediatric Dentistry. As part of the requirements for a M.S.D. degree, I am pursuing a thesis project which will analyze the extent of orthodontic treatment being provided by Pediatric Dentists and General Practitioners in the State of Indiana. As you undoubtedly know, this is quite a current concern and influences the delivery of dental care to the public.

You have been specifically selected to participate in this survey as a representative of Indiana dentists. The main purpose of this study is to determine if current dental education programs are adequately preparing recent graduates for modern practice. Your participation in the survey may greatly affect your future colleagues.

The enclosed questionnaire has been carefully designed to be completed within ten minutes. Your responses will remain completely anonymous and frank answers to the questions will be appreciated.

I will be grateful for the prompt return of your completed form by March 10. An addressed and stamped envelope has been enclosed for your convenience.

I anticipate publishing the results of this study in the dental literature. Results will also be available through the School of Dentistry Library, once the project is completed. If you have any questions concerning this project, please feel free to contact me.

Thank you for your particpation in this project which I hope will benefit future dental education and practice.

Sincerely yours,

Lorne D. Koroluk, D.M.D
Resident in Pediatric Dentistry

APPENDIX 4

"Orthodontic training in undergraduate dental education is very limited. I think more emphasis should be placed on this phase of dentistry so that general dentists would feel more confident about occlusion when they start their practices."

"My undergraduate orthodontic training was very weak."

"Undergraduate orthodontic training and education is very deficient."

"School was a joke! Its lack of training is causing us to go somewhere else for adequate training."

"At the time I graduated from dental school the orthodontic training was totally worthless. They could have easily taught us simple movements which we see the need for many times."

"General dentists with proper training should be able to handle cases under their scope, in much the same way as in endodontics, oral surgery and periodontics."

"Orthodontic education in dental school when I took it was pathetically poor in retrospect."

"Undergraduate orthodontic education was pathetic."

"Undergraduate ortho training was virtually nonexistent."

"After graduation, I felt very poorly prepared to do more than band and loop space maintainers. I think there is a definite need in the undergraduate dental education for more orthodontic instruction."

"General practicing dentists need to be better trained in orthodontic procedures."

"Undergraduate orthodontics was totally inadequate."

"The lack of training in orthodontics for undergraduates in dental school has cost me thousands of dollars in continuing education time."

"Increased orthodontic training for undergraduates is overdue. In my opinion, the general dentist should provide comprehensive orthodontic treatment."

"I consider myself a good dentist but I consider myself woefully inadequate at treating any orthodontic situation."

CURRICULUM VITAE

Lorne David Koroluk

June 28, 1955	Born to John and Pearl Koroluk Invermay, Saskatchewan, Canada
May, 1981	B.Sc. (Advanced) University of Saskatchewan Saskatoon, Saskatchewan
May, 1982	D.M.D. University of Saskatchewan College of Dentistry Saskatoon, Saskatchewan
July 1982 to June 1983	Dental General Practice Residency University Hospital Saskatoon, Saskatchewan
April 7, 1984	Married Sherril Lee Campbell Saskatoon, Saskatchewan
July 1984 to July 1986	Graduate Student, Pediatric Dentistry Indiana University School of Dentistry James Whitcomb Riley Hospital for Children Indianapolis, Indiana
July, 1986	Appointed, Assistant Professor Community and Pediatric Dentistry University of Saskatchewan Saskatoon, Saskatchewan

Professional Organizations

Canadian Dental Association
Saskatchewan College of Dental Surgeons
American Dental Association
American Academy of Pediatric Dentistry
American Society of Dentistry for Children

ABSTRACT

ANALYSIS OF ORTHODONTIC TREATMENT BY PEDIATRIC DENTISTS AND GENERAL PRACTITIONERS IN INDIANA

by

Lorne D. Koroluk

Indiana University School of Dentistry
Indianapolis, Indiana

Orthodontic treatment being provided by pediatric dentists and general practitioners in Indiana was investigated. A two page questionnaire constructed by the investigator was used to gather the data.

The study sample consisted of 571 dentists. All 71 Indiana pediatric dentists primarily in private practice were surveyed. General practitioners (500) were chosen on the basis of age, year of graduation from dental school, geographic location and size of community in which they practiced.

Seventy-eight percent of the questionnaires were returned; of this total, 93 percent of the pediatric dentists and 77 percent of the general practitioners responded.

The study showed that currently in Indiana 62 percent of the pediatric dentists and 17.9 percent of the general practitioners surveyed provided comprehensive orthodontic treatment. These results are much higher than results of previous surveys of pediatric dentists and general practitioners.

The study also found that pediatric dentists provide significantly more comprehensive orthodontic treatment and spend significantly more time providing orthodontic treatment than do general practitioners.

Age of practitioner was found not to significantly affect the percentage of time spent providing orthodontic treatment, the orthodontic conditions treated or the type of appliances and techniques used.

Population of the community in which the practice was located did have a significant effect. Practitioners in communities of over 100,000 provided significantly less comprehensive orthodontic treatment. Practitioners who practiced in communities of 5,000-25,000 spent significantly more time providing orthodontic services.

Sixty-three percent of the practitioners surveyed had taken some type of continuing education course in orthodontics.

An overwhelming majority of practitioners (over 90 percent) stated that their undergraduate orthodontic training in dental school inadequately prepared them for private practice. The majority of pediatric dentists (78 percent) also stated that their postgraduate education instruction in orthodontics was inadequate.